AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An optical logic gate comprising:

a first digital input for receiving a first optical digital input signal;

a digital output for outputting an optical digital output signal which is a function of at least the first optical digital input signal; and

a first lasing semiconductor optical amplifier (LSOA) having an amplifier input, an amplifier output, a pump, and a first ballast laser output, the amplifier input of the first LSOA operably coupled to the first digital input, and the first ballast laser output of the first LSOA operably coupled ~~between the first digital input and~~ to the digital output.

2. (Withdrawn) The optical logic gate of claim 1 wherein the LSOA comprises:

a semiconductor gain medium;

an amplifying path coupled to the amplifier input and to an amplifier output and passing through the semiconductor gain medium; and

a laser cavity including the semiconductor gain medium and coupled to the ballast laser output.

3. (Withdrawn) The optical logic gate of claim 2 wherein the laser cavity has a laser threshold whereby a ballast laser signal from the laser cavity is extinguished if the ballast laser signal represents a digital zero.

4. (Withdrawn) The optical logic gate of claim 2 further comprising:

a gain element coupled between the ballast laser output of the LSOA and the digital output of the optical logic gate for adjusting an amplitude of the ballast laser signal so an amplitude of the optical digital output signal is the same as an amplitude of the first optical digital input signal when the optical digital output signal and the first optical digital input signal represent a same digital logic level.

5. (Currently Amended) The optical logic gate of claim 1 wherein:

the optical logic gate is an optical NOT gate, the first LSOA comprising a semiconductor gain medium having a depletion threshold, the first ballast laser output emitting a weak or strong laser signal based on a function of the intensity of the first optical digital input signal,

wherein the first optical digital input signal having a weak intensity causes the semiconductor gain medium to be below the depletion threshold such that a strong laser signal is emitted from the ballast laser output, and

wherein the first optical digital input signal having a strong intensity causes the semiconductor gain medium to be above the depletion threshold such that a weak laser signal is emitted from the ballast laser output.

6. (Currently amended) The optical logic gate of claim 5 wherein:

~~the first digital input of the optical logic gate is coupled to the amplifier input of the LSOA;~~

~~the ballast laser output of the LSOA is coupled to the digital output of the optical logic gate; and~~

~~the LSOA has a laser threshold whereby~~

if the first optical digital input signal comprises a weak intensity, then the first optical digital input signal is a digital zero, and a ~~ballast~~ strong laser signal from the ballast laser output causes the optical digital output signal to be a digital one; and

if the first optical digital input signal comprises a strong intensity, then the first optical digital input signal is a digital one, and a weak ~~the ballast~~ laser signal from the ballast laser output causes the optical digital output signal to be a digital zero.

7. (Currently Amended) The optical logic gate of claim 6 wherein the intensity of the first optical digital input signal is strong enough such that ~~LSOA has the laser threshold whereby if the first optical digital input signal is a digital one,~~ the ballast laser signal is extinguished.

8. (Currently Amended) The optical logic gate of claim 1 wherein the optical logic gate is an optical NOR gate further comprising:

a second digital input for receiving a second optical digital input signal; and

an optical combiner operably coupled to the first digital input and the second digital input, the optical combiner further having a combiner output, the optical combiner configured to combine the first optical digital input signal and the second optical digital input signal to form a combined optical digital input signal exiting the combiner output, the combiner output being operably coupled to the amplifier input of the first LSOA.

9. (Currently Amended) The optical logic gate of claim 31 ~~8 further comprising:~~

~~an optical combiner having two inputs and an output, the two inputs coupled to the first digital input and to the second digital input, and the output coupled to the amplifier input of the LSOA;~~

~~wherein the ballast laser output of the LSOA is coupled to the digital output of the optical logic gate; and~~

wherein ~~the LSOA has a laser threshold whereby~~:

if both the first and second ~~combiner~~ optical digital input signals ~~are~~ comprise a weak intensity such that the combined optical digital input signal comprises a weak intensity, then the first and second optical digital input signals are a digital zero, and a strong ~~ballast~~ laser signal from the first ballast laser output causes the optical digital output signal to be a digital one; and

if at least one of the first and second optical digital input signals comprises a strong intensity, then the first and/or second optical digital input signal having a

strong intensity is a digital one, and a weak ~~ballast~~ laser signal from the first ballast laser output causes the optical digital output signal to be a digital zero.

10. (Currently Amended) The optical logic gate of claim 9 wherein the intensity of the first optical digital input signal is strong enough such that ~~LSOA has the laser threshold whereby if at least one of the first and second optical digital input signals is a digital one,~~ the ballast laser signal is extinguished.

11. (Currently Amended) The optical logic gate of claim 1 wherein the optical logic gate is an optical NAND gate further comprising:

a second digital input for receiving a second optical digital input signal;

a second lasing semiconductor optical amplifier (LSOA) having an amplifier input, an amplifier output, a pump, and a second ballast laser output, the amplifier input of the second LSOA operably coupled to the second digital input; and

an optical combiner operably coupled to the first ballast laser output and the second ballast laser output, the optical combiner having a combined output, the combined output being operably coupled to the digital output, the optical combiner configured to combined the signals from the first ballast laser output and the second ballast laser output to form the optical digital output signal to be emitted from the digital output.

12. (Currently Amended) The optical logic gate of claim 32 ~~11 further comprising:~~

~~an optical combiner having a first input and a second input and an output, the first combiner input coupled to the ballast laser output of the first LSOA, and the output coupled to the digital output of the optical logic gate; and~~

~~a second LSOA having an amplifier input coupled to the second optical digital input and a ballast laser output coupled to the second combiner input.~~

wherein ~~the first LSOA has a laser threshold wherein, response to the first optical digital input signal being a digital signal~~:

if at least one of the first and second optical digital input signals comprise a weak intensity, then the first or second optical digital input signal having a weak intensity is a digital zero, and ~~a ballast laser signal from the ballast laser output causes~~ the optical digital output signal ~~to be~~ is a digital one; and

if both the first and second optical digital input signals comprise a strong intensity, then the first and second optical digital input signals are each a digital one, and the ~~ballast laser signal from the combined ballast laser output causes the~~ optical digital output signal ~~to be~~ is a digital zero.

13. (Cancelled)

14. (Original) The optical logic gate of claim 1 wherein the LSOA is a vertical lasing semiconductor optical amplifier (VLSOA).

15. (Original) The optical logic gate of claim 1 wherein the LSOA is a transverse lasing semiconductor optical amplifier (TLSOA).

16. (Original) The optical logic gate of claim 1 wherein the LSOA is a longitudinal lasing semiconductor optical amplifier (LLSOA).

17. (Withdrawn) An optical latch, comprising:

a set input;

a reset input;

a first output;

a second output;

a first lasing semiconductor optical amplifier (LSOA), comprising:

an input for receiving optical signals and connected to the set input; and

a laser output connected to the first output for outputting a first laser output optical signal in response to the received optical signals;

a second LSOA, comprising:

an input for receiving optical signals and connected to the reset input and to the laser output of the first LSOA; and

a laser output connected to the second output and to the input of the first LSOA for outputting a second laser output optical signal in response to the received optical signals;

wherein, in response to a high signal being input to the set input, and a low signal being input to the reset input, reaching a first stable state where the first output is low and the second output is high; and

wherein, in response to a high signal being input to the reset input, and a low signal being input to the set input reaching a second stable state where the first output is high and the second output is low.

18. (Withdrawn) The optical latch of claim 17, wherein the first LSOA further comprises:

a laser cavity with an optical path;

an amplifying path connected to the input and passing through the laser cavity for propagating the optical signals received at the input;

a pump input connected to the laser cavity for receiving a pump for exceeding a lasing threshold for the laser cavity; and

wherein the laser output outputs the first laser output optical signal in response to the received optical signals propagating through the amplifying path.

19. (Withdrawn) The optical latch of claim 17, further comprising:

a first combiner connected to the set input, the input of the first LSOA, and the laser output of the second LSOA for receiving optical signals from the set input and the laser output of the second LSOA and outputting a combined optical signal to the input of the first LSOA; and

a second combiner connected to the reset input, the input of the second LSOA, and the laser output of the first LSOA for receiving optical signals from the set input and the laser output of the first LSOA and outputting a combined optical signal to the input of the second LSOA.

20. (Withdrawn) The optical latch of claim 17, further comprising:

a first splitter connected to the laser output of the first LSOA, the input of the second LSOA, and the first output for receiving optical signals from the laser output of the first LSOA and outputting the received optical signals to the input of the second LSOA and the first output; and

a second splitter connected to the laser output of the second LSOA, the input of the first LSOA, and the second output for receiving optical signals from the laser output of the second LSOA and outputting the received optical signals to the input of the first LSOA and the second output.

21. (Withdrawn) An optical logic gate, comprising:

a lasing semiconductor optical amplifier (LSOA) having an amplifier input, a ballast laser output, and an amplifier output;

a time delay having an input coupled to the ballast laser output for receiving a ballast laser output signal, an output coupled to the amplifier input for, at a later time, sending the ballast laser output optical signal to the amplifier input; and a digital output coupled to the amplifier output for outputting a periodic substantially square waveform optical signal.

22. (Withdrawn) The optical logic gate of claim 21, wherein the time delay is a length of optical fiber.

23. (Withdrawn) The optical logic gate of claim 21, wherein the time delay is silicon.

24. (Withdrawn) The optical logic gate of claim 21, the LSOA further comprising a laser cavity with an optical path having a variable optical path length.

25. (Withdrawn) The optical logic gate of claim 24, the laser cavity of the LSOA further comprising:

a first mirror; and

a second mirror separated from the first mirror by a distance, the distance being variable.

26. (Withdrawn) The optical logic gate of claim 25, wherein the first mirror is a micro electromechanical system (MEMS) mirror with a variable position.

27. (Withdrawn) The optical logic gate of claim 26, the LSOA further comprising a conducting layer for varying the position of the first mirror by applying a selected voltage between the first mirror and the conduction layer.

28. (Withdrawn) The optical logic gate of claim 21, the LSOA further comprising a tunable region with a selectable refractive index.

29. (Withdrawn) The optical logic gate of claim 21, the time delay being a variable time delay.

30. (Withdrawn) The optical logic gate of claim 21, the time delay further comprising a tunable region with a selectable refractive index.

31. (New) The optical logic gate of claim 8, wherein:

the first LSOA comprises a semiconductor gain medium, the semiconductor gain medium being set at a depletion threshold, the first ballast laser output emitting a weak or strong laser signal based on a function of the intensity of the combined optical digital input signal,

wherein a combined optical digital input signal having a weak intensity causes the semiconductor gain medium to be below the depletion threshold such that a strong laser signal is emitted from the ballast laser output, and

wherein a combined optical digital input signal having a strong intensity causes the semiconductor gain medium to be above the depletion threshold such that a weak laser signal is emitted from the ballast laser output.

32. (New) The optical logic gate of claim 11, wherein:

the first and second LSOAs each comprising a semiconductor gain medium, the semiconductor gain medium being set at a depletion threshold, the first and second ballast laser outputs emitting a weak or strong laser signal based on a function of the intensity of the first and second optical digital input signals, respectively,

wherein a first or second optical digital input signal having a weak intensity causes the semiconductor gain medium to be below the depletion threshold such that a strong laser signal is emitted from the first or second ballast laser output, and

wherein a first or second optical digital input signal having a strong intensity causes the semiconductor gain medium to be above the depletion threshold such that a weak laser signal is emitted from the first or second ballast laser output.

33. (New) A method for forming an optical logic gate comprising:

forming a first digital input for receiving a first optical digital input signal;

forming a digital output for outputting an optical digital output signal which is a function of at least the first optical digital input signal;

operably coupling the first digital input to an amplifier input of a first lasing semiconductor optical amplifier (LSOA), the first LSOA having a semiconductor gain medium; and

operably coupling the digital output to a first ballast laser output of the first LSOA.

34. (New) The method as recited in claim 33, further comprising:

determining a depletion threshold;

inputting a first optical digital input signal into the first digital input, wherein the first ballast laser output emits a weak or strong laser signal based on a function of the intensity of the first optical digital input signal,

wherein a first optical digital input signal having a weak intensity causes the semiconductor gain medium to be below the depletion threshold such that a strong laser signal is emitted from the first ballast laser output, and

wherein a first optical digital input signal having a strong intensity causes the semiconductor gain medium to be above the depletion threshold such that a weak laser signal is emitted from the first ballast laser output.

35. (New) The method as recited in claim 34, wherein

if the first optical digital input signal comprises a weak intensity, then the first optical digital input signal is a digital zero, and a strong laser signal from the ballast laser output causes the optical digital output signal to be a digital one; and

if the first optical digital input signal comprises a strong intensity, then the first optical digital input signal is a digital one, and a weak laser signal from the ballast laser output causes the optical digital output signal to be a digital zero.

36. (New) The method as recited in claim 33, further comprising:

forming a second digital input for receiving a second optical digital input signal;

operably coupling the amplifier input of the first LSOA to the second digital input;

operably coupling the first digital input and the second digital input to an optical combiner; and

operably coupling a combined output of the optical combiner to the amplifier input of the first LSOA.

37. (New) The method as recited in claim 36, further comprising:

determining a depletion threshold;

inputting a first optical digital input signal into the first digital input;

inputting a second optical digital input signal into the second digital input; and

combining the first optical digital input signal and the second optical digital signal to form a combined optical digital input signal;

wherein the first ballast laser output emits a weak or strong laser signal based on a function of the intensity of the combined optical digital input signal,

wherein a combined optical digital input signal having a weak intensity causes the semiconductor gain medium to be below the depletion threshold such that a strong laser signal is emitted from the ballast laser output, and

wherein a combined optical digital input signal having a strong intensity causes the semiconductor gain medium to be above the depletion threshold such that a weak laser signal is emitted from the ballast laser output.

38. (New) The method as recited in claim 37, wherein:

if both the first and second optical digital input signals comprise a weak intensity such that the combined optical digital input signal comprises a weak intensity, then each of the first and second optical digital input signals are a digital zero, and a strong laser signal from the first ballast laser output causes the optical digital output signal to be a digital one; and

if at least one of the first and second optical digital input signals comprises a strong intensity, then the first and/or second optical digital input signal having a strong intensity is a digital one, and a weak laser signal from the first ballast laser output causes the optical digital output signal to be a digital zero.

39. (New) The method as recited in claim 33, further comprising:

forming a second digital input for receiving a second optical digital input signal;

operably coupling the second digital input to an amplifier input of a second LSOA, the second LSOA having a semiconductor gain medium;

operably coupling the first ballast laser output of the first LSOA to an optical combiner;

operably coupling a second ballast laser output of the second LSOA to the optical combiner; and

operably coupling a combined output of the optical combiner to the digital ouput.

40. (New) The method as recited in claim 39, further comprising:

determining a depletion threshold for the first LSOA;

inputting a first optical digital input signal into the first digital input; and

wherein the first ballast laser output emits a weak or strong laser signal based on a function of the intensity of the first optical digital input signal,

wherein a first optical digital input signal having a weak intensity causes the semiconductor gain medium to be below the depletion threshold such that a strong laser signal is emitted from the first ballast laser output, and

wherein a first optical digital input signal having a strong intensity causes the semiconductor gain medium to be above the depletion threshold such that a weak laser signal is emitted from the first ballast laser output.

41. (New) The method as recited in claim 40, further comprising:

determining a depletion threshold for the second LSOA; and

inputting a second optical digital input signal into the second digital input,

wherein the second ballast laser output emits a weak or strong laser signal based on a function of the intensity of the second optical digital input signal,

wherein a second optical digital input signal having a weak intensity causes the semiconductor gain medium to be below the depletion threshold such that a strong laser signal is emitted from the second ballast laser output, and

wherein a second optical digital input signal having a strong intensity causes the semiconductor gain medium to be above the depletion threshold such that a weak laser signal is emitted from the second ballast laser output.

42. (New) The method as recited in claim 41, further comprising combining the first ballast laser output and the second ballast laser output to form an optical digital output signal, wherein:

if at least one of the first and second optical digital input signals comprise a weak intensity, then the first or second optical digital input signal having a weak intensity is a digital zero, and the optical digital output signal is a digital one; and

if both the first and second optical digital input signals comprise a strong intensity, then the first and second optical digital input signals are each a digital one, and the optical digital output signal is a digital zero.